Accuracy Characteristics for ZFW Risk Reduction Conflict Scenario, Hours 1815-2024

1 Introduction

This document contains an abridged version on the scenario characteristics for hours 1815 to 2024 (actual recorded data from 18:15:30 to 20:24:26) GMT recorded on December 4, 2002 at Fort Worth ARTCC (ZFW). Characteristics provided are general statistics determined from the scenario on general air traffic activity and aircraft and air carrier characteristics. Definitions for these scenario characteristics are provided in [1]. Definitions for the conflict and encounters in Tables 1 and 2 are further explained in [2] and [3].

2 Conflict and Encounter Properties

Table 1: Conflict Parameter Distributions

			Non Time-Shifted	Time Shifted[1]	
		Required Sample Size[2] (1.25x)	Reference (x)	Conflict Analysis 1	Conflict Analysis 2
	Number of Conflicts	165	75	168	134
Horizontal Separation	0 to 1 nm	55 33.33%	25 33.33%	53 31.55%	41 30.60%
	1 to 2 nm	31 18.79%	14 18.67%	32 19.05%	28 20.90%
	2 to 3 nm	33 20.00%	15 20.00%	35 20.83%	22 16.42%
	3 to 4 nm	24 14.55%	11 14.67%	26 15.48%	23 17.16%
	4 to 5 nm	22 13.33%	10 13.33%	22 13.10%	20 14.93%
Vertical Separation	0 to 400 ft	149 90.30%	68 90.67%	150 89.29%	118 88.06%
	400 to 800 ft	13 7.88%	6 8.00%	13 7.74%	10 7.46%
	800 to 1200 ft	0 0.00%	0 0.00%	2 1.19%	3 2.24%
	1200 to 1600 ft	2 1.21%	1 1.33%	2 1.19%	2 1.49%
	1600 to 2000 ft	0 0.00%	0 0.00%	1 0.60%	1 0.75%
Encounter Angle	0º to 30º	92 55.76%	42 56.00%	116 69.05%	95 70.90%
	30º to 60º	13 7.88%	6 8.00%	13 7.74%	11 8.21%
	60º to 90º	20 12.12%	9 12.00%	21 12.50%	17 12.69%
	90º to 120º	4 2.42%	2 2.67%	4 2.38%	3 2.24%
	120º to 150º	4 2.42%	2 2.67%	4 2.38%	3 2.24%
	150º to 180º	31 18.79%	14 18.67%	10 5.95%	5 3.73%
Phase of Flight	Level-Level	51 30.91%	23 30.67%	36 21.43%	34 25.37%
	Level-Trans	53 32.12%	24 32.00%	48 28.57%	35 26.12%
	Trans-Trans	62 37.58%	28 37.33%	84 50.00%	65 48.51%

[1] Conflict Analysis 1 includes analysis on the Conflict Scenario evaluated based on aircraft tracks starting at the inbound handoff and ending at center crossing boundary (same as Reference Scenario). Conflict Analysis 2 includes the same Conflict Scenario evaluated based on aircraft tracks starting at the first HCS recorded track report and ending at outbound handoff (this is same rules used in URET CCLD Formal Accuracy Test).

[2] Required sample size counts are scaled to account for different aircraft quantity in Analysis Scenarios (i.e. 488 flights in the Reference Scenario and 647 in the Analysis Scenarios).

Table 2: Encounter Parameter Distributions

		Non Time-Shifted	Time Shifted[3]	
		Reference[4]	Encounter Analysis 1	Encounter Analysis 2
	Number of Encounters	2151	1797	1442
Horizontal Separation	0 to 5 nm	371 17.25%	339 18.86%	270 18.72%
	5 to 10 nm	389 18.08%	271 15.08%	212 14.70%
	10 to 15 nm	373 17.34%	312 17.36%	265 18.38%
	15 to 20 nm	438 20.36%	356 19.81%	282 19.56%
	20 to 25 nm	580 26.96%	519 28.88%	413 28.64%
Vertical Separation	0 to 1000 ft	992 46.12%	759 42.24%	638 44.24%
	1000 to 2000 ft	165 7.67%	178 9.91%	158 10.96%
	2000 to 3000 ft	614 28.54%	570 31.72%	415 28.78%
	3000 to 4000 ft	139 6.46%	134 7.46%	100 6.93%
	4000 to 5000 ft	241 11.20%	156 8.68%	131 9.08%
Encounter Angle	0º to 30º	640 29.75%	478 26.60%	431 29.89%
	30º to 60º	225 10.46%	174 9.68%	147 10.19%
	60º to 90º	215 10.00%	170 9.46%	130 9.02%
	90º to 120º	164 7.62%	171 9.52%	138 9.57%
	120º to 150º	234 10.88%	230 12.80%	166 11.51%
	150º to 180º	674 31.33%	574 31.94%	430 29.82%
Phase of Flight	Level-Level	809 37.61%	585 32.55%	439 30.44%
	Level-Trans	672 31.24%	649 36.12%	525 36.41%
	Trans-Trans	670 31.15%	563 31.33%	478 33.15%

[3] Same as footnote 1 for encounter analysis. Note: time shifting methodology targeted generation of twice the Reference Scenario's conflict distribution, but the distribution of encounters are achieved only as a consequence.
[4] Reference Scenario counts are scaled to account for different aircraft quantity in Analysis Scenarios.

3 Air Traffic Distributions

This section provides metrics that characterize the air traffic. The metrics are flight density partitioned by standard flight levels, flight type and sector penetration, statistics on the number of active flights, ground speed statistics, counts of interim altitude and amendment messages, and air traffic maneuvers by altitude and phase of flight. This section corresponds to Section 3.3 of Reference[1].

3.1 Active Flights

This section corresponds to section 3.3.2 of Reference[1].

Table 1: Statistics on Active Flights per Minute Increment

Count Average	Standard Deviation	Maximum Count	Minimum Count
164.1333	92.38464	269	0

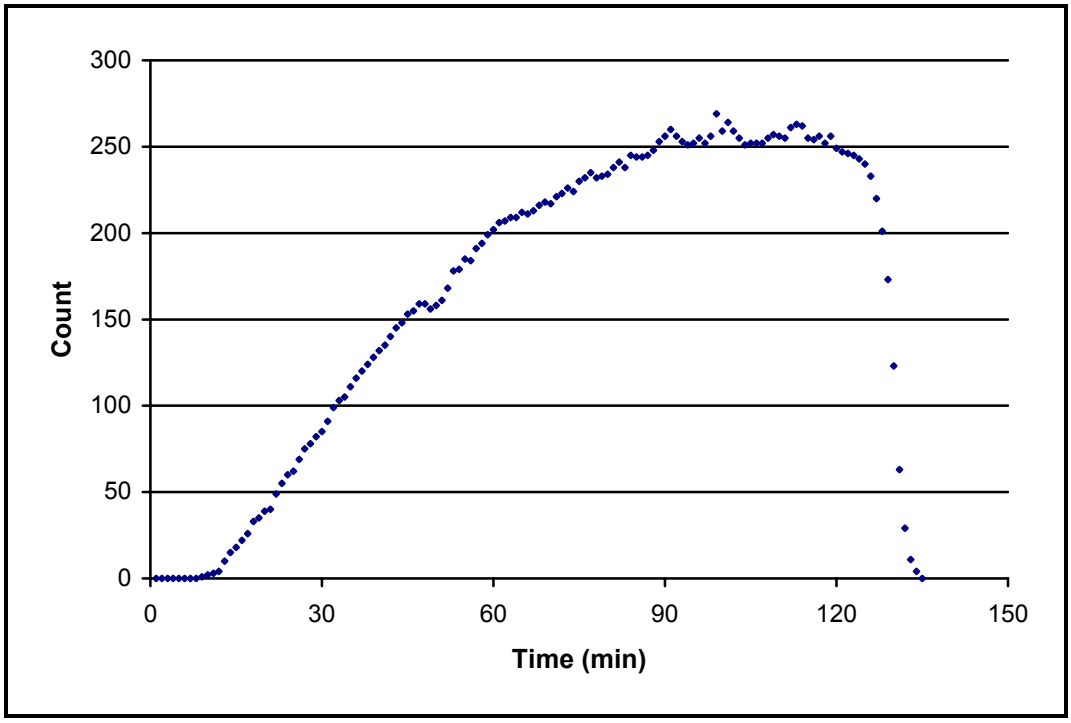

Figure 1: Count of Active Flights per Minute Increment

3.2 Flight Type and Sector Penetration

This section corresponds to Section 3.3.3 of Reference[1].

Table 2: Statistics on Sector Time, Center Time and Sector Penetration by Flight Type

Metric	Arrivals	Departures	Internals	Overflights	All Flights
Average Number of Sectors Penetrated	2.253	2.271	2.043	2.394	2.286
Average Time in Center (sec)	1408.764	1187.685	1105.106	1391.549	1311.005
Average Time in Sector (sec)	617.855	515.835	532.604	572.922	565.822
Percentage by Flight Type	27.512	31.376	7.264	32.921	100.000

3.3 Interim Altitude Messages

This section corresponds to Section 3.3.6 of Reference[1].

Table 3: Statistics on Interim Altitude Messages [5]

Flight Count	Average	Standard Deviation	Maximum Count	Minimum Count
391	2.595908	0.906039	7	1

3.4 Amendment Messages

This section corresponds to Section 3.3.7 of Reference[1]

Table 4: Statistics on Amendment Messages per Flight[6]

Flight Count	Average	Standard Deviation	Maximum Count	Minimum Count
331	2.154079	1.447194	9	1

[5] Statistics on flights with interim altitude messages only
[6] Statistics on flights with flight plan amendments only

3.5 Air Traffic Maneuvers

This section corresponds to Section 3.3.8 of Reference[1]. Detailed statistics on air traffic maneuvers are provided in Appendix C.

Table 5: Total Track Report Maneuver Count by Vertical and Horizontal Phase of Flight

Vertical Phase	Horizontal Phase of Flight		Total
	STR	TURN	
ASC	4890	932	5822
DES	4987	820	5807
LEV	1321	780	2101
Total	11198	2532	13730

Table 6: Percent breakdown of Flight Tracks by Vertical and Horizontal Phase

Vertical Phase	Horizontal Phase of Flight		Margin (%)
	STR (%)	TURN (%)	
ASC	35.615	6.788	42.403
DES	36.322	5.972	42.294
LEV	9.621	5.681	15.302
Margin (%)	81.559	18.441	100.000

4 Aircraft Distributions

This sections provides the metrics used to characterize the aircraft provided in the scenario. The selected metrics are aircraft type, model, navigational equipment, and the air carriers operating in the airspace. The section corresponds to Section 3.4 of Reference[1].

4.1 Aircraft Type

This section corresponds to Section 3.4.1 of Reference[1].

Table 7: Count by Aircraft Type

Aircraft Type	Count	Percentage of Total
J	524	83.974
P	19	3.045
T	75	12.019
U	29	4.647
Total	647	103.686

4.2 Aircraft Models

This section corresponds to Section 3.4.2 of Reference[1].

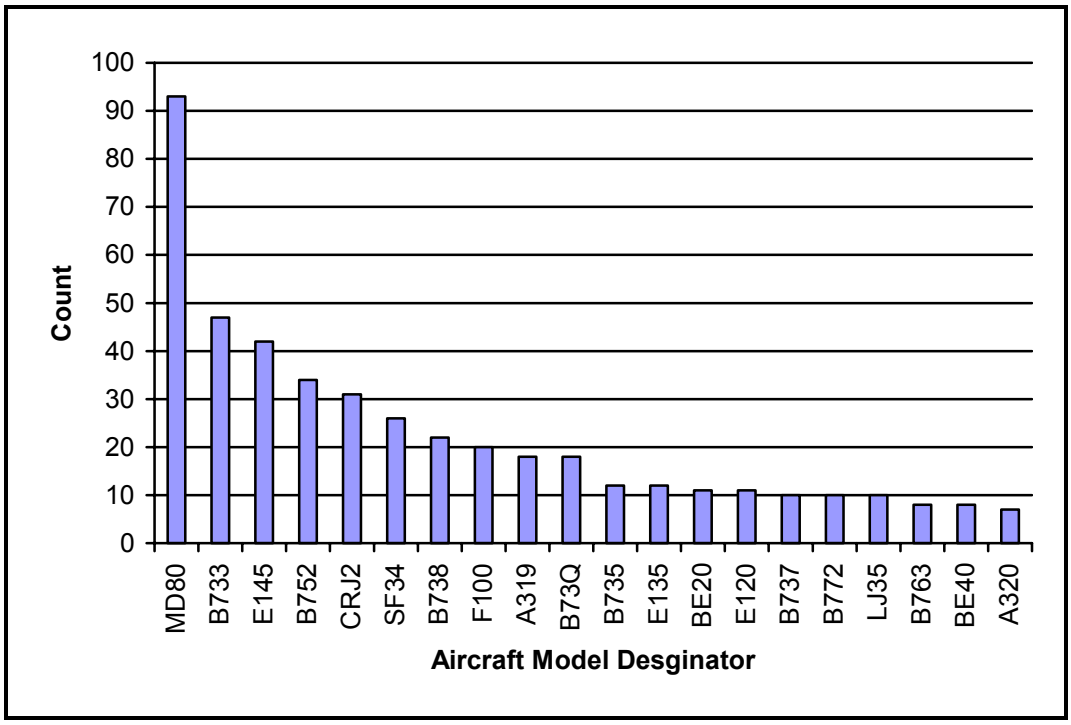

Figure 2: Count of Top Twenty Aircraft Models

4.3 Navigational Equipage

This section corresponds to Section 3.4.3 of Reference[1].

Table 8: Count by Aircraft Navigational Equipage Type

Nav. Equip. Designator	Count	Percentage of total
G	175	27.048
E	128	19.784
F	103	15.920
I	85	13.138
A	84	12.983
R	39	6.028
W	13	2.009
Q	12	1.855
U	7	1.082
P	1	0.155
Total	647	100.000

4.4 Carrier Distribution

This section corresponds to Section 3.4.4 of Reference[1].

Table 9: Count by Carrier Type

Category	Count	Percentage of Total
Commercial	500	77.280
General Aviation	113	17.465
Other[7]	34	5.255
Total	647	100.000

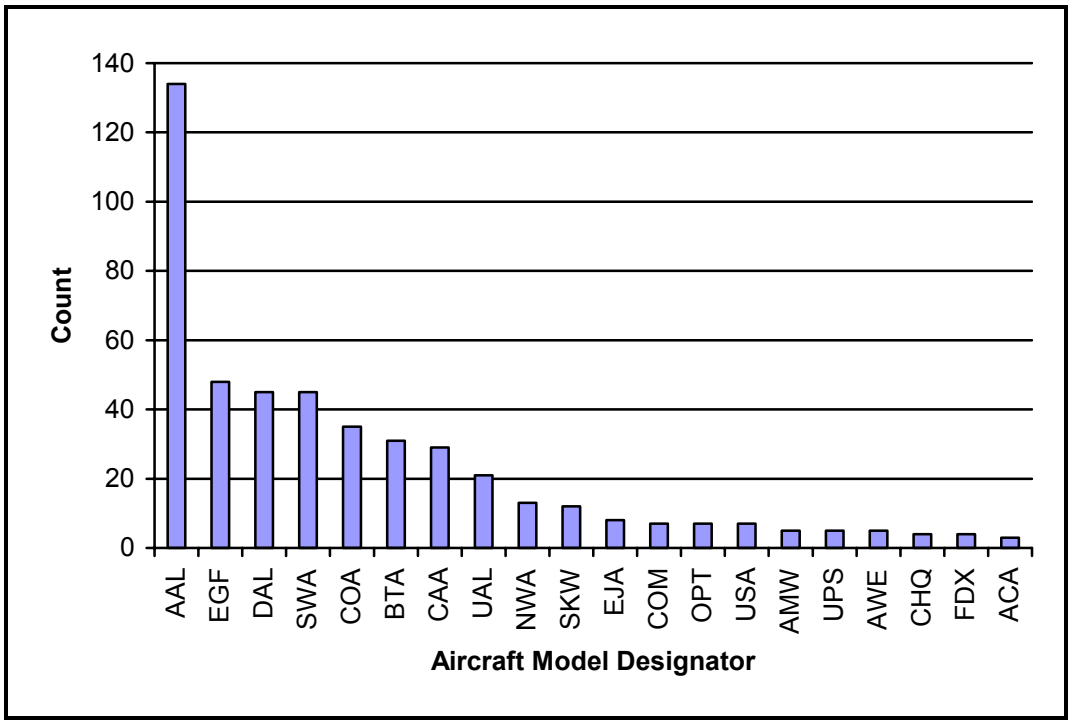

Figure 3: Count by Top Twenty Air Carriers

[7] Includes military and aircraft with unrecognized designators

5 Reference

[1] Paglione, M., Oaks, R., Ryan, Dr. H., Summerill, J.S., (Final, January 2000), "Description of Accuracy Scenarios for the Acceptance Testing of the User Request Evaluation Tool (URET) / Core Capability Limited Deployment (CCLD)," FAA William J. Hughes Technical Center / ACT-250, Atlantic City, New Jersey.

[2] Paglione, Mike M., Oaks, Robert D., Summerill, J. Scott, "Time Shifting Air Traffic Data for Quantitative Evalution of a Conflict Probe," Submitted to the *American Institute of Aeronautics and Astronautics (AIAA) Guidance, Navigation, and Control Conference*, Austin TX, August 2003.

[3] Paglione, Mike M., Oaks, Robert D., Bilimoria, Karl D., "Methodology for Generating Conflict Scenarios by Time Shifting Recorded Traffic Data," Submitted to 5th *USA/EUROPR Air Traffic Management R&D Seminar*, Budapest, Hungary, June 2003.